

Notes on reproduction of captive *Bassariscus sumichrasti* (Procyonidae)

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Abstract

Studied the reproductive behavior, including precopulatory and copulatory behavior, as well as estrous cycles in captive *Bassariscus sumichrasti*. Average duration of estrus is 44.4 days. Fertilization is possible only during a single day. ♂♂ mount estrous ♀♀ 5 to 30 days before the ♀♀ are able to conceive. These mountings are resisted by the ♀♀, and most if not all, do not lead to intromission. One to 2 successful copulations terminate the pair's sexual activities. It is hypothesized that *B. sumichrasti* ♀♀ may have induced ovulation, released by prolonged periods of frequent sexual stimulation by the ♂. The gestation period was determined to be 64 to 66½ days. Births of singletons are the rule.

Introduction

The Central American or tropical cacomixtle, *Bassariscus sumichrasti*, has been rarely kept in zoos or private collections. Breeding success in captivity has been limited. This paper reports on the reproductive behavior of captive *Bassariscus sumichrasti*, compared with that of captive *Bassariscus astutus*.

B. sumichrasti is an arboreal, nocturnal, omnivorous carnivore. It is recognized as a solitary animal (ALVAREZ DEL TORO 1977; POGLAYEN-NEUWALL, pers. observ.), but a feeding aggregation of 9 individuals in a fruiting tree without conflicts among the animals has been observed (R. MORALES, pers. comm.).

Material and methods

Six ♂ and 3 ♀ Central American captive cacomixtles were observed over periods of up to 19 years in order to compile an ethogram for the species. Animals were kept singly, in pairs of opposite and same gender, in enclosures of 2×2×2, 6×8×2, and 2×3×2 m. Three of the cages were located outdoors, 4 indoors. Outdoor cages had natural soil substrate, all others cement floors. Each cage was structured with climbing branches, and at least 2 wooden, elevated sleeping boxes with 2 clear plastic viewing panels. Because of the extreme heat (up to 45 °C) and aridity of southern Arizona, outdoor enclosures were well shaded and provided with either evaporative coolers or overhead water misters. For protection from inclement winter weather (rarely more than 3 degrees below freezing at night) outdoor enclosures were covered on all sides with plastic sheeting, with closeable openings on one side for observation. Heat lamps were used when necessary.

Animals were fed in the evening a mixture of selected fruits, dry dogchow softened with water, a fresh-killed chick, occasionally a small rodent, quail eggs and insects (beetles, grasshoppers, crickets, moths). Dried skim milk, a calcium-phosphate powder and multivitamins were added to the rations. Fresh water was always available.

Photographs were taken with Nikon F2 and F3 cameras and strobe light if necessary, and observations were taken down on note pads or tape recorders. Photoperiods were not artificially manipulated.

Results and discussion

A captive pair of Honduran *Bassariscus sumichrasti variabilis* ("Nuevo" and "Honda") was observed by the author, copulating on 9 February 1974, 1600 h. During the following 2 days the ♀ evaded the ♂, and on the third day postcopulam the ♂ had lost all interest in the ♀. Total duration of this estrus was 34 days ("estrus" in this paper comprises proestrus, estrus and metestrus; no effort has been made to differentiate the various stages). The copulation was preceded by 14 days of numerous brief mountings of the recalcitrant ♀. These mountings occurred throughout the night, each lasting only a few seconds, and none leading to intromission (Fig. 1). On the average, 24 mountings/h were registered. On 9 February the animals were already active at 1530 h when 11 attempted copulations were observed within 3.5 min. Typically, ♂ mounts and attempts intromission 5 to 30 days before the ♀ becomes receptive. Until maximum tumescence of the vulva is attained the ♀ thwarts all mating attempts of the ♂ by turning, rolling onto her back, geckering, squealing, and finally escaping the ♂'s clasp. As an example may serve a captive ♂ *B. s. variabilis* and a ♀ *B. s. sumichrasti*: the ♂ was introduced to the ♀ a week before she had reached the peak of estrus. On the 3rd day the ♂ started to pursue the ♀. Within a 40-min observation period the ♂ made 47 unsuccessful attempts to copulate. Until the resistance of the ♀ was overcome 4 days later (the 30th day of estrus), 280 mounting attempts were noted. The true number was certainly considerably higher since counts were not carried out during the entire activity period of the animals. The ♀'s vulva had returned to the anestrus state by the 42nd day.

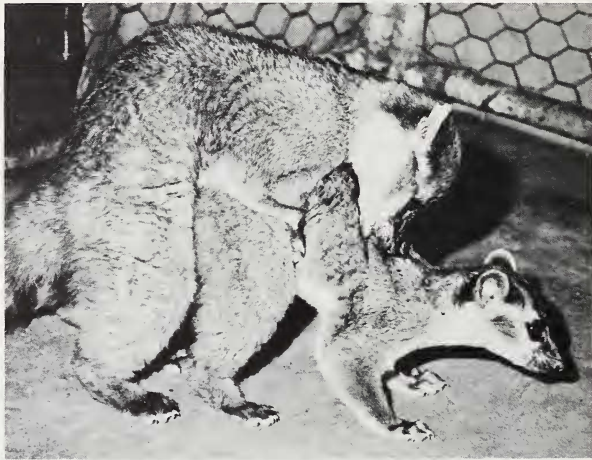


Fig. 1. Copulatory position. Note ♂ grasping skin of nape with teeth to hold/position ♀

A copulatory bout per se takes up to 6 min or longer, and in principle does not differ from that in *B. astutus*, as described by BAILEY (1974) and POGLAYEN-NEUWALL (1987), except that there is no evidence of continual vocalizing of the ♀, comparable to the "matting chitter" of the ♀ *B. astutus*. It may be that *B. sumichrasti* is an induced ovulator, the ♀ requiring long and intense sexual stimulation. Successful copulations are few, I observed only one in one ♀, and 2 in another; they are confined to 24 h of the ♀'s reproductive cycle. Another procyonid, *Procyon lotor*, of the temperate and subtropical life zones, copulates 3 to 4 days consecutively (POGLAYEN-NEUWALL, pers. observ.). It is believed to be the only induced ovulator in the family (LLEWELLYN and ENDERS 1954). However, SANDERSON (1983) asserts that *P. lotor* is a spontaneous ovulator.

Sexual activity during daylight hours is not an artefact of captivity of this otherwise strictly nocturnal species, since a copulating pair of *B. sumichrasti* was observed in a tree about 1600 h in late April in SW Chiapas (P. ALEGRIA, pers. comm.).

Mounting in play context was seen repeatedly in 2 unrelated $\delta\delta$, about 15 months old, mostly conducted by the dominant individual. I also observed pseudo-copulatory mountings, especially in the δ "Nuevo", whenever a f was introduced or reintroduced, regardless of whether she was in heat or not. Approach and mountings were always accompanied by characteristic reassuring chirps of the δ . Naso-nasal contact and mutual sniffing of various body parts are common in this situation. In the case of an anestrus f these interactions may last several min, mounting attempts are perfunctory and repelled or evaded by the f .

The reproductive strategy of the δ *B. sumichrasti*, attempting copulations many days prior to the receptivity of the f , markedly differs from the copulatory pattern of *B. astutus*, whose attempts at copulation are restricted to a 24-h-period, and the δ is almost always successful in achieving penetration early (POGLAYEN-NEUWALL 1987).



Fig. 2. δ sniffing f ano-genitally prior to mounting

In *B. sumichrasti* the δ tests the estrous condition of the f by licking her urine off the substrate, and sniffing or licking over her feces. After testing, the δ sometimes raises his head for up to 3 sec, but I have not observed the grimace typical of flehmen. Brief sniffing of their own feces outside the sexual context is common in both sexes immediately after elimination. Initially, the δ makes naso-genital contact with the f (Fig. 2), also sniffs along her tail, uttering incessant appeasing chirping, to which the f only rarely responds with the same vocalization. The δ may lick over the f 's vulva, neck and shoulder region, with the f eventually reciprocating with brief grooming of the δ 's head, and sniffing at his ano-genital area. The posterior aspect of the semi-pendulous, large scrotum, being bald, pinkish and very conspicuous in *B. sumichrasti*, has undoubtedly a signalling function. During her estrus the f sniffs at the scrotum more often than at the penal area. By comparison the scrotum of *B. astutus* is considerably smaller relative to the animal's size, and the posterior section almost totally haired and thus not conspicuous. The f seems to be less interested in the scrotum of the δ in this species. Frequently, between mating bouts, $\delta\delta$ sit upright on their haunches, less often crouched across a tree limb, licking their genital area with or without unsheathed penis, even when no prior vaginal contact

had occurred. The ♀♀ likewise groom their vaginal area after most mountings, whether successful or not, sitting on the small of their back, hind legs straddled.

It is noteworthy, that the Honduran pair "Nuevo" and "Honda" bred only once successfully, although 5 estrous periods with extensive sexual activity occurred, including one estrus 14 days postpartum, i.e. 10 days after the death of the infant. Twenty subsequent estrous cycles (1973, 1979, 1980, 1982, 1984 twice, and thrice during 1981, 1983, 1985), when associated with another Honduran ♂, did not result in pregnancy despite countless mountings by this new ♂. No observations were made from September 1986 till September 1987, thus only one estrus was recorded for the year 1986. In 1988 "Honda", then approximately 18 years old, had her last estrus. In *B. astutus* the last estrus was observed at the age of 10 years (D. GIULIANI, pers. comm.). This may be explained by the markedly shorter life expectancy (in captivity) of *B. astutus* (16 years 6 months) than that of *B. sumichrasti* (over 24 years) (POGLAYEN-NEUWALL 1989).

If a raccoon (*Procyon lotor*) fails to mate during her first estrus of the year, she may go through a second estrus later in the same year (SANDERSON and NALBANDOV 1973) but not a third cycle. Among the sexually mature, nulliparous and multiparous *B. astutus* in the collection of this writer, not a single one showed evidence of a second estrus within the same calendar year; all were late winter or spring cycles. A *B. astutus* at the New Orleans (Louisiana) and one at the Norfolk (Virginia) zoos, that once gave birth in September, also had only one estrus in the year; supposedly none of these were postpartum cycles (R. HOYT, C. SWEET, pers. comm.).

During the observed cycles of 1979–1988 the ♀ "Honda" and her second mate demonstrated ambivalent sexual behavior. The ♀ often solicited the ♂, approaching with chirping vocalizations and mounting him, sometimes also carrying out a brief bout of pelvic thrusts (Fig. 3). The ♂ always twisted free, uttering loud gecker vocalizations, characteristic of the non-receptive ♀. Both animals thus acted out reversed roles.

Data for 3 ♀♀ show that estrus occurred in every month of the year, most in March, April, May and June. Duration of estrus, based on vulval morphology and copulatory behavior, was 44.4 days (range = 22–69 days; n = 29). Since more than one estrus per year

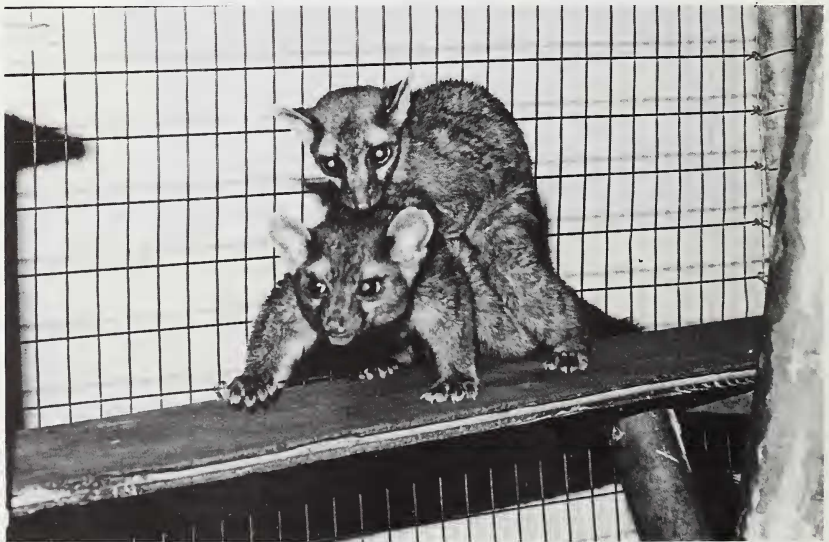


Fig. 3. Estrous ♀ mounting/soliciting ♂

has so far been observed in these 3 ♀♀ only, not counting one postpartum cycle, it would be too early to infer that this species is polyestrous.

In comparison with *B. astutus* I found that *B. sumichrasti* do not have testicular regression (checked by periodic palpation of 4 mature ♂♂) retain sexual libido, and, considering also the October birth at a Guatemala zoo, may thus have spermatogenesis throughout the year. Histological examinations of testes/epididymides at different times of the year are planned.

A ♀ *B. sumichrasti sumichrasti*, "Pinta", was taken with her mate from the same tree hole near Sontecomapán, southern Veracruz, on 19 April 1989. The ♀ showed extreme vulval swelling, and copulations took place soon afterward in a small cage. They did not produce offspring. I assume, if conception occurred, that stress of capture and transport caused resorption of the embryo in an early state. An estrus of this ♀ from 8 March to 13 April 1990, and a second one from 7 July to 5 August was likewise non-productive. Another ♀, "Vera", acquired in March 1989 showed estrus from 2 April to 13 May 1990, at which time she conceived. The 29-day-old infant of this ♀ had to be removed for hand-rearing on 30 July. On 9 August "Vera" entered a new cycle (duration 22 days). Her previous mate was re-introduced and numerous attempts at copulation were observed during several days. Reproductive behavior began in the afternoon, the earliest copulation attempt at 1350 h, and lasted throughout the night with only brief rest periods, until approximately 0400 h. This estrus cannot be called "postpartum" nor "postlactation" estrus, as it does not fit into the time frame of either. It did not result in conception.

After a gestation period of 66 days 13 hours a young was born to "Honda" (sired by "Nuevo") on 16 April 1974 at 0600 h (Fig. 4). The 1990 litter of "Vera" (sired by a Chiapan ♂) likewise consisted of a single ♂ offspring. This young was born on 3 July 1990, at 1345 h, after a gestation of 64 days. These gestation periods contrast with those of 51 days 8 h to 54 days reported for *B. astutus* (POGLAYEN-NEUWALL and POGLAYEN-NEUWALL 1980).

Bassariscus sumichrasti births have been recorded at the regional zoo in Tuxtla Gutiérrez, Chiapas (April 1959) of an 11-year-old ♀ (M. ALVAREZ DEL TORO, pers. comm.), and at the Auto-Safari Chapin, Guatemala, 15 October 1988, 5 May 1989, and 8 May 1990 (F. BERGER, pers. comm.). In each case singletons were born of which only the last



Fig. 4. 3-day-old ♂; weight: 40.5 g

mentioned, a ♀, survived. The occurrence of litters of single young in *B. astutus* is uncommon. ARANDA and MARCH (1987), GAMERO-IDIAQUEZ (1978), GAUMER (1917), HALL (1981), and JANSON (1981) quote the number of young to be 2 to 4; ALVAREZ DEL TORO (1977) mentions 1 to 2, 3 being the exception. A ♀ collected (field number 3502) by G. G. MUSSEY on 17 March 1965 near Las Tuxtlas, Veracruz, and deposited at the Zoology Museum, Univ. Michigan, Ann Arbor, carried 4 embryos of 70–75 mm head-rump length, which I assume would have been born in early April. Since ♀ *B. sumichrasti*, unlike ♀ *B. astutus* with 4 teats, possess only 2 inguinal teats, and the size of the fetuses reported in the field notes of MUSSEY would be too large for possible resorption, it cannot be excluded that these fetuses were taken from another species and erroneously attributed to the ♀ quoted.

Months of birth are thought to be March (GAUMER 1917) and April–July (ALVAREZ DEL TORO 1977). HALL (1981) assumes breeding to take place in January. Although the sample is still small, clearly there is a concentration of reproduction (estrous cycles, matings, and births) from February to July inclusively.

Acknowledgements

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Zusammenfassung

Bemerkungen zur Fortpflanzung von Bassariscus sumichrasti (Procyonidae) in Gefangenschaft

Das Fortpflanzungsverhalten von *Bassariscus sumichrasti*, einschließlich Präkopulations- und Kopulationsverhalten, sowie Östruszzyklen wurden untersucht. Die durchschnittliche Länge des Östrus beträgt 44,4 Tage. Befruchtung ist nur an einem Tag möglich. ♂♂ versuchen, mit ♀♀ während deren Hitze bereits 5 bis 30 Tage, bevor diese empfangen können, zu kopulieren. Die ♀♀ wehren sich in diesem Stadium erfolgreich gegen die aggressiven ♂♂, so daß es kaum zur Intromissio kommt. Erfolgreiche Kopulationen während des Gipfels des Östrus beenden schließlich die sexuelle Tätigkeit des Paares. Es wird angenommen, daß *B. sumichrasti* einen induzierten Eisprung hat, der durch eine längere Periode häufigen Aufreitens des ♂ ausgelöst wird.

Die Tragzeit für diese Art wurde mit 64 bis 66½ Tagen festgelegt. Einzelgeburten sind die Regel.

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